Exploring Cocoa Honey-Based Drinks: A Technical-Scientific Mapping Perspective

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Products rich in cocoa are highly energetic and offer various health benefits, including anti-inflammatory, antioxidant, analgesic, and vasodilatory properties. Cocoa production generates several by-products, including cocoa honey, a nutritious liquid extracted from the pulp of cocoa seeds. This by-product has the potential to develop functional beverages, catering to the growing demand for healthy foods. A search combining keywords and the Cooperative Patent Classification (CPC) code was performed in the Espacenet and Derwent (DWPI) databases. The scientific study investigated cocoa honey's composition, nutritional properties, and health effects, while the patent analysis sought to identify innovations related to its use. The goal was to provide insights into new functional and innovative products. The study revealed a need for more specific patents on cocoa honey, particularly at the national level.
Keywords: Cocoa. Cocoa Honey. Functional Drink. Patents.

Cocoa (*Theobroma cacao L.*) is a fruit of American origin belonging to the *Sterculiaceae botanical* family, typically found in tropical regions. Its planting is best done during the rainy season, which provides the necessary shade for optimal development [1]. *Theobroma cacao L.* is a dicotyledonous, neotropical tree with three genetic varieties [2,3]. The variability in cocoa characteristics can be influenced by the region in which it is cultivated, impacting the final product's traits [4].

Brazil is unique in having a complete production chain, being both a producer of cocoa and an industrial processor of cocoa beans, as well as a manufacturer of chocolate [5,6].

During the production process, particularly in the post-harvest phase, a significant amount of waste is generated, including cocoa shells, pulp, and cocoa honey. Approximately 80% of the fruit is considered waste, making it feasible to redirect this by-product for industrial use [7]. Cocoa honey, a thick liquid obtained during pulp extraction, is a by-product characterized by high perishability. It can be consumed fresh or undergo further processing, such as thermal pasteurization [8].

Despite its significant nutritional value, its utilization is limited, and its commercial use is at most 1% of the available quantity.

Cocoa-rich foods are renowned for their health benefits, which include anti-inflammatory, antioxidant, antimicrobial, analgesic, and vasodilatory properties [9]. Cocoa honey is an exceptionally nutritious product with an average pH of 2.76, imparting a naturally acidic flavor that limits the development of contaminating microorganisms [5,6]. Notably, it contains vitamin C, ranging from 7.64% to 10.9%.

With the growing demand for functional foods and beverages, there is a significant trend towards developing new products with beneficial health effects. In this context, cocoa-based drinks, such as those containing cocoa honey, have considerable growth potential due to their high nutritional value [8].

Therefore, minimizing waste generated by the cocoa industry and adding value to by-products is imperative for the sustainability of food processing. This study aims to investigate the potential for developing new functional fermented drinks containing cocoa honey through a bibliographic and patent analysis.

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Materials and Methods

Two specific Cooperative Patent Classification (CPC) codes were used to ensure a broad scope of the research. According to the search strategy, these codes were linked to English keywords: 'Cocoa honey' and 'food' and 'beverage,' with codes A23G1/00 and A23L21/25, respectively (Table 1).

The research was conducted from August to November 2023. Patents associated with cocoa honey drinks were individually reviewed to map information about protected technologies relevant to the proposed investigation. It is important to note that certain patents may not appear in search results due to the eighteen-month confidentiality period. The search used Espacenet and Derwent World Patents Index (DII) to build a comprehensive table comparing patents registered in 90 countries, including Brazil. Graphs were generated using the Derwent platform, considering the main CPCs, year of highest patent publication, and countries of publication.

Results and Discussion

Approximately four patents were associated with cocoa honey-based drinks with functional properties based on the selection of the primary patents related to the keyword "cocoa honey and food and beverage" (Table 2). Among these, only two specifically focused on using cocoa honey in producing a functional drink; the others used cocoa honey as a sweetener or additive.

Among the companies and institutions holding patents for fermented drinks with functional effects, The Princeton Group Inc. stands out with five linked patents, followed by Nestlé with four patents (Figure 1). Additionally, the Federal University of Bahia holds two patents, all related to fermented drinks based on cocoa honey, which is the focus of this study. Functional foods are gaining popularity worldwide due to their metabolic and health-promoting effects and essential nutritional functions. Despite identifying several patents using the keywords, cocoa honey still needs to be explored

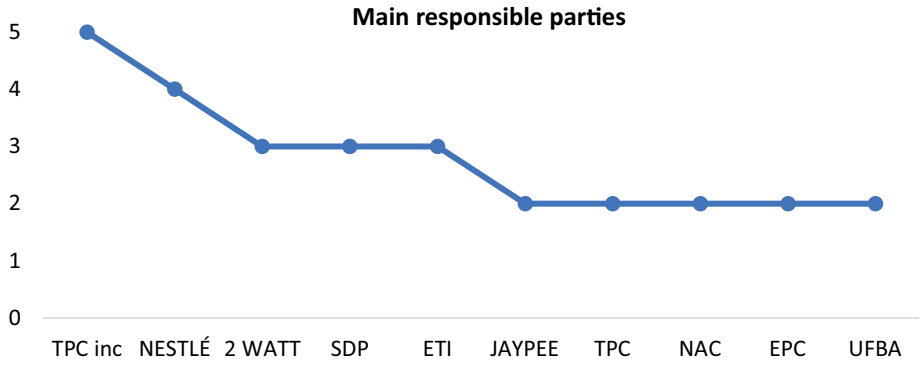
Table1. Description of Cooperative Patent Classification (CPC) codes.

CPC Code	Meanings
A23G1/00	Cocoa; cocoa products, e.g. chocolate; and substitutes
A23L21/25	Food or foodstuffs; non-alcoholic drinks; its preparation, e.g. cooking, nutritional quality modification; Honey; honey substitutes

Table 2. Keyword scheme.

Keywords	Individual Documents ESPACENET	Derwent Innovation
Honey cocoa	87	154
Honeu cocoa and food	58	108
Honey cocoa and Beverage	18	30
Honey cocoa and food and beverage	34	24
Honey cocoa and A23L21/25	8	9
Honey cocoa and A23G1/00	7	10

Figure 1. Leading companies and institutions holding patents.



in innovative scientific circles, mainly due to the scarcity of studies on its conservation and technological improvement. However, utilizing cocoa honey can add value to the by-products generated in the cocoa processing chain and bring benefits through innovative products. Although the highest concentration of patents regarding functional drinks is in Asian countries and outside South America, there is limited foreign literature on cocoa honey-based drinks, with only national patents observed. This is due to several factors, such as cocoa honey being a by-product of the cocoa harvest and its rapid degradation. There is limited knowledge on how to preserve cocoa honey long-term without freezing.

Conclusion

Through this mapping, it is possible to design a product based on the results of the patents and market analysis, focusing on cocoa honey-based drinks. Furthermore, we aim to facilitate future research on using this by-product, considering one of the challenges faced: the scarcity of literature, especially in English, that comprehensively addresses cocoa honey.

Although the Asian continent has a significantly greater number of patents related to beverages and functional foods, the patents for beverages made from cocoa honey are exclusive to Brazil. This initiative aims to reduce waste generated in chocolate production, promoting a more conscious and sustainable industrial approach while also seeking to optimize the efficiency of the process.

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